

Special Purpose Devices

Special Purpose Devices

Introduction

Since the development of the transistor, continuous research in the field of semiconductors has provided many additional semiconductor devices. Some of these devices have been adopted to applications that were normally impossible. These devices, now considered as innovations in military and commercial equipment, may become as commonplace as the junction transistor is today. Indications are that development and applications for solid state devices will continue to expand. In all cases, where other devices were previously used, the solid state devices are smaller, more efficient, less expensive, and more reliable.

Two of these devices, the uni-junction transistor (UJT) and the silicon controlled rectifier (SCR), will be discussed in detail during this lesson.

Special Purpose Devices

2 Types; Silicon Controlled Rectifier, [SCR]
 Unijunction Transistor, [UJT]

Both are classified in the family of electronic switches called, Thyristors.

Electronic Switches are;

1. Faster
2. Less Expensive
3. Last Longer
4. Have No Arc or Spark as do manual switches & relays.

Applications SCR;

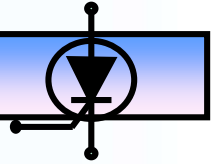
1. High Voltage & Current
>2000 V & >1500 A
2. Speed Controls for motors

Applications UJT;

1. Trigger for an SCR
2. Oscillator

Special Purpose Devices

SCR: Silicon Controlled Rectifier.



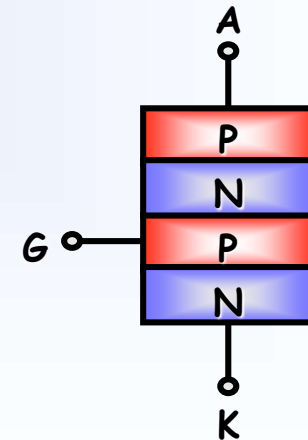
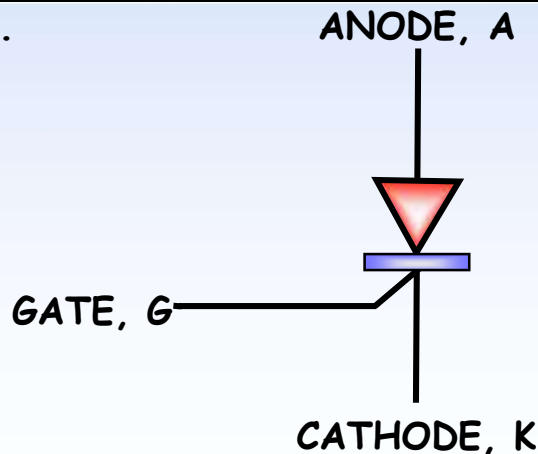
4 Layer PNPN Device, W/3 PN Junctions.

Looks like a diode, acts like a diode, current flows like a diode, W/ an extra element called a Gate.

A small + DC or + spike applied to the Gate will turn on [Gated On] the device provided forward biasing is set on the Anode & Cathode. Once ON, Stays ON.

To Turn OFF, forward biasing must be removed or reversed Biased.

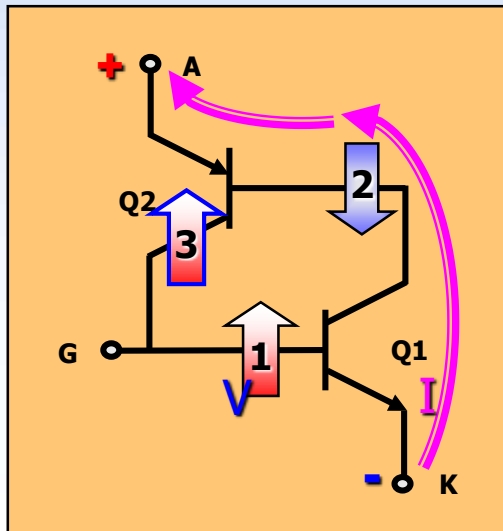
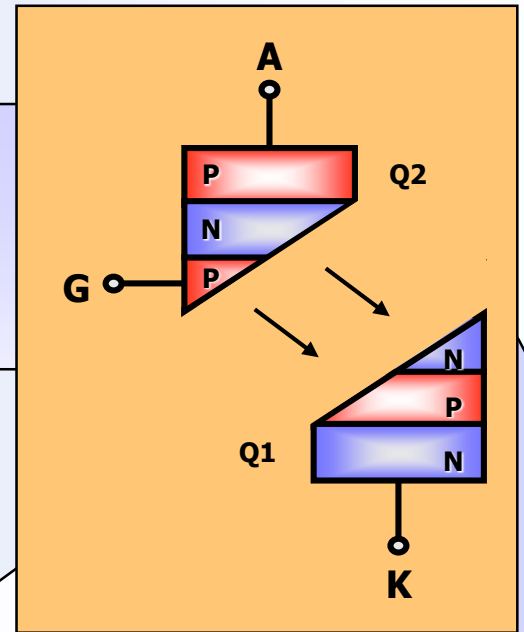
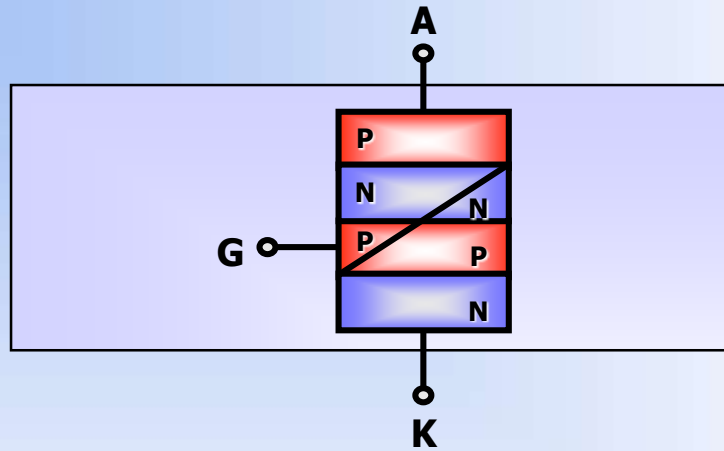
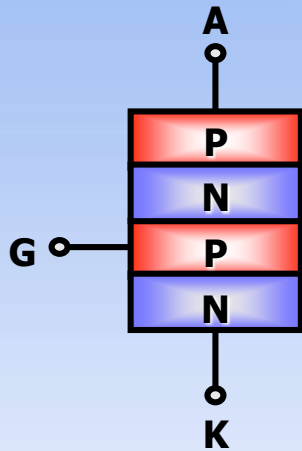
The GATE WILL NOT SHUT DOWN conduction. [Latching Current must be removed].



SCR, Gated ON

Special Purpose Devices

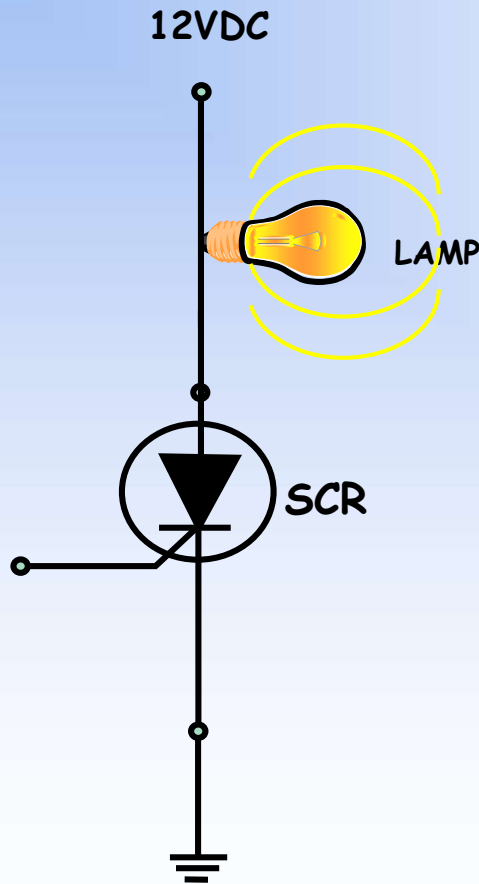
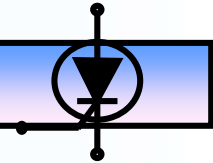
SCR: Gated On, Latched On.



SCR, Power

Special Purpose Devices

SCR; Efficient Power use.



$$P = I \times E$$

$$P_{LAMP} = I_{LAMP} \times E_{LAMP}$$

$$P_{LAMP} = 50 \text{ ma} \times 11\text{v}$$

$$P_{LAMP} = 550 \text{ mW}$$

$$P = I \times E$$

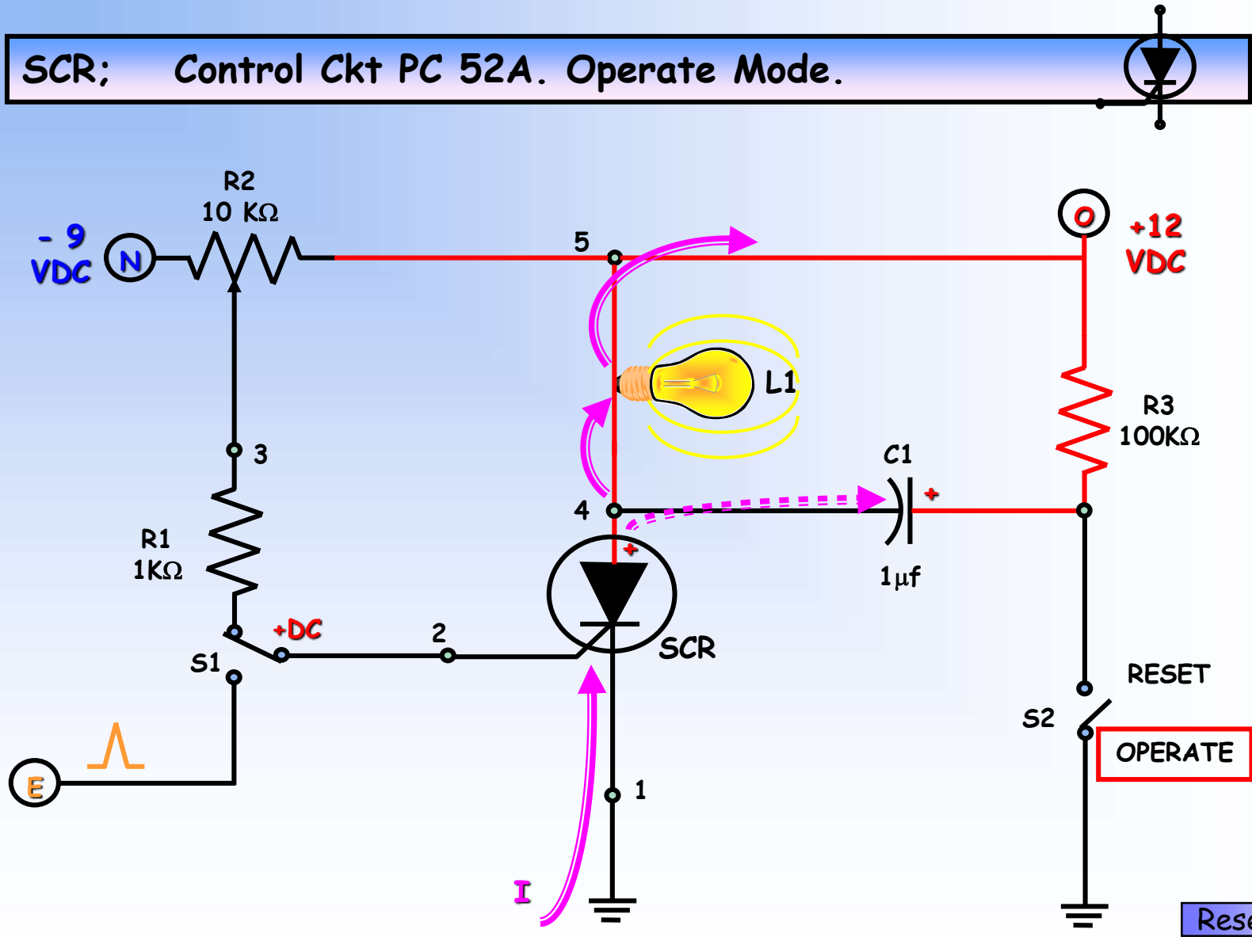
$$P_{SCR} = I_{SCR} \times E_{SCR}$$

$$P_{SCR} = 50\text{ma} \times 1\text{v}$$

$$P_{SCR} = 50 \text{ mW}$$

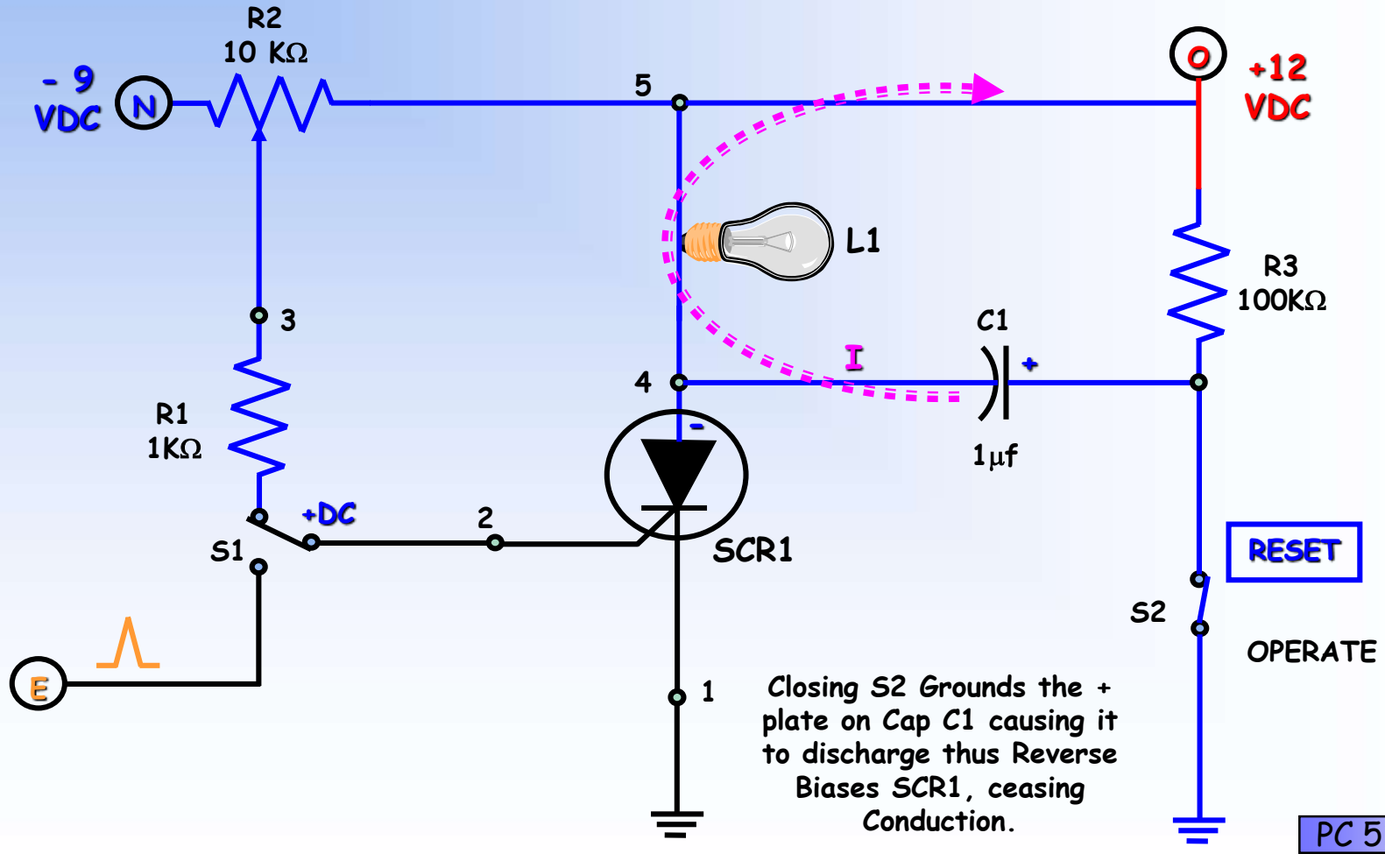
Special Purpose Devices

SCR; Control Ckt PC 52A. Operate Mode.



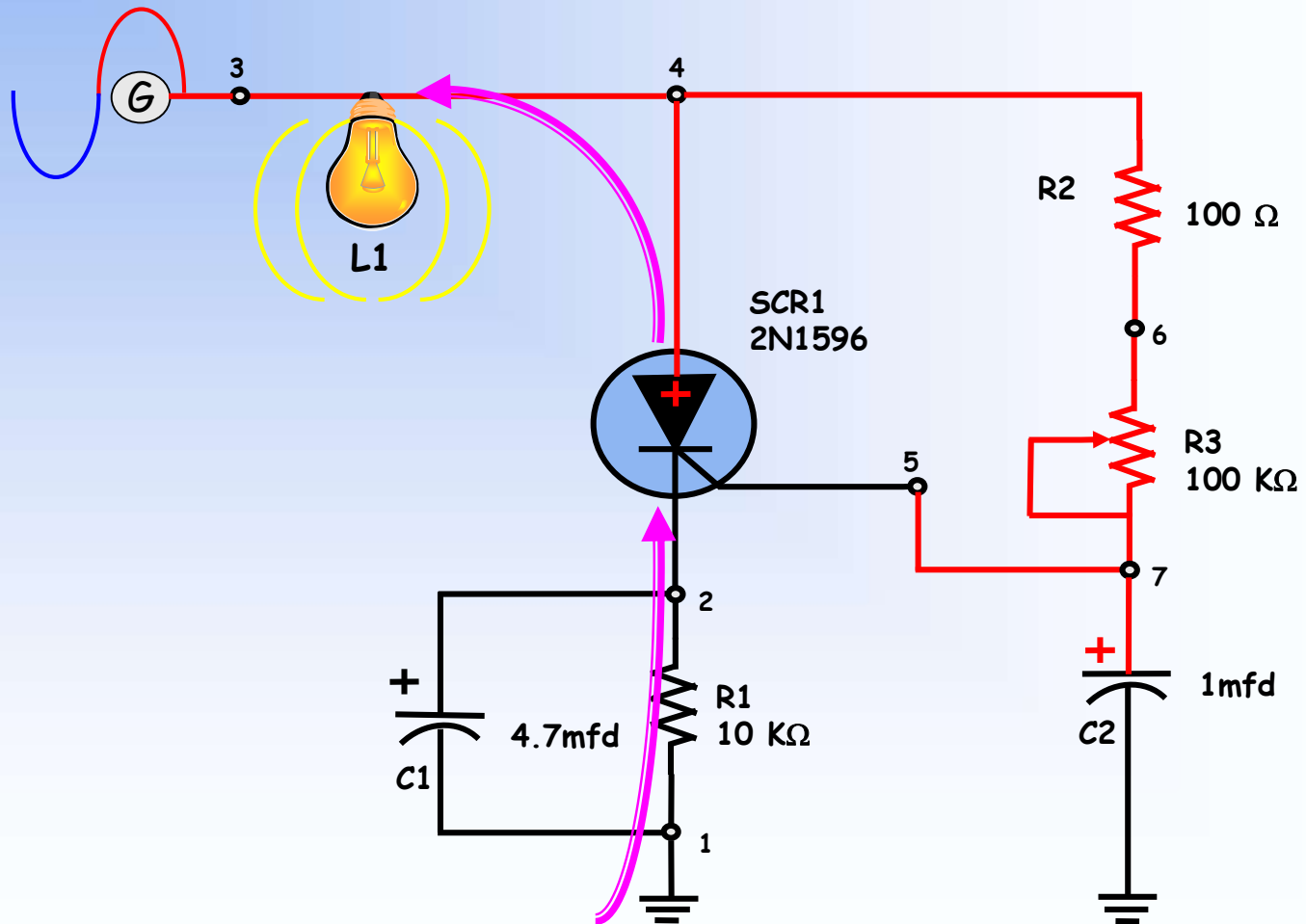
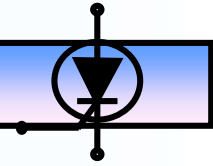
Special Purpose Devices

SCR; Control Ckt PC 52A. Reset Mode.



Special Purpose Devices

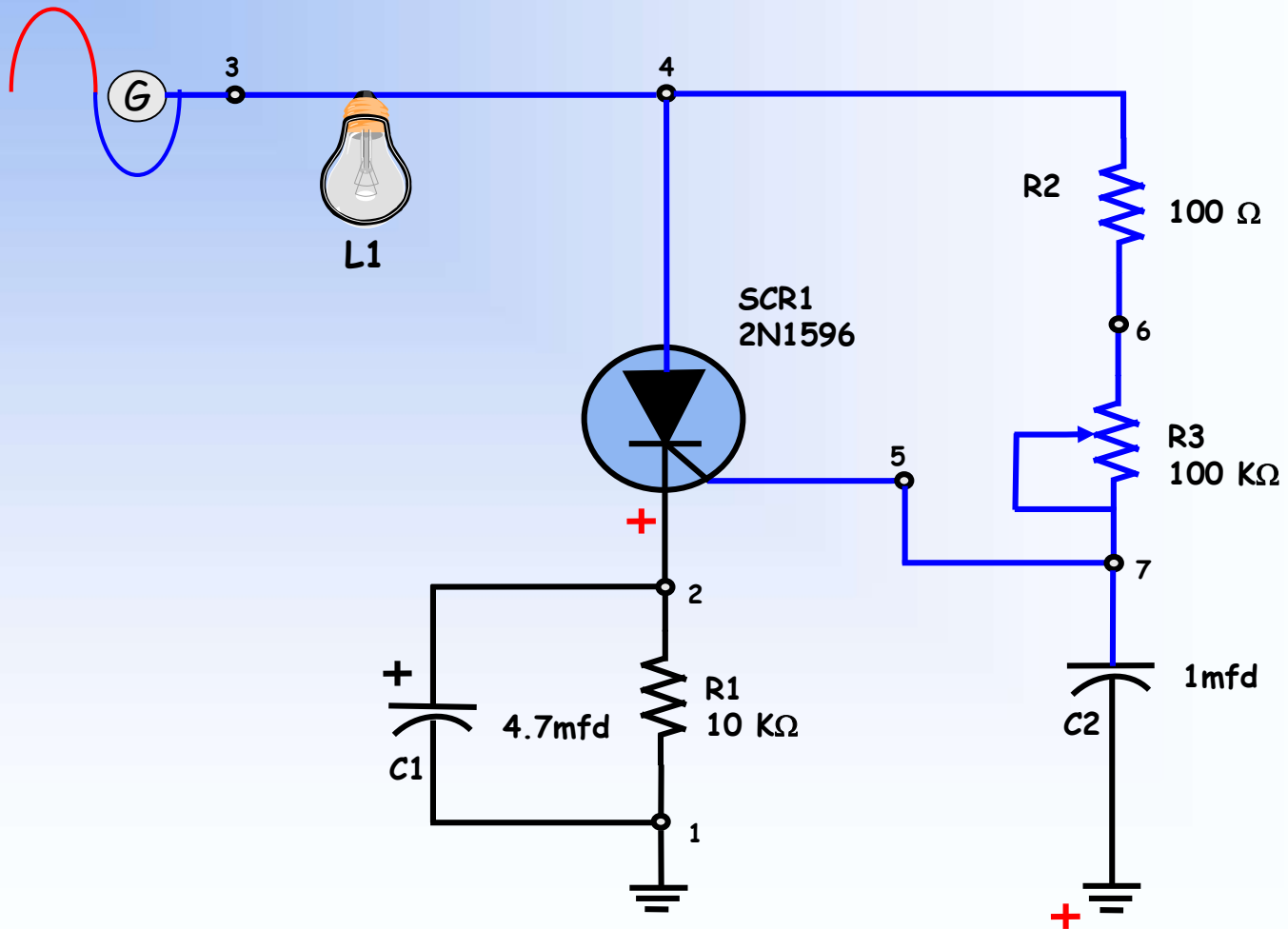
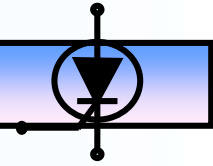
SCR; Ckt PC 52B. Conducting.



PC 52B, Cutoff

Special Purpose Devices

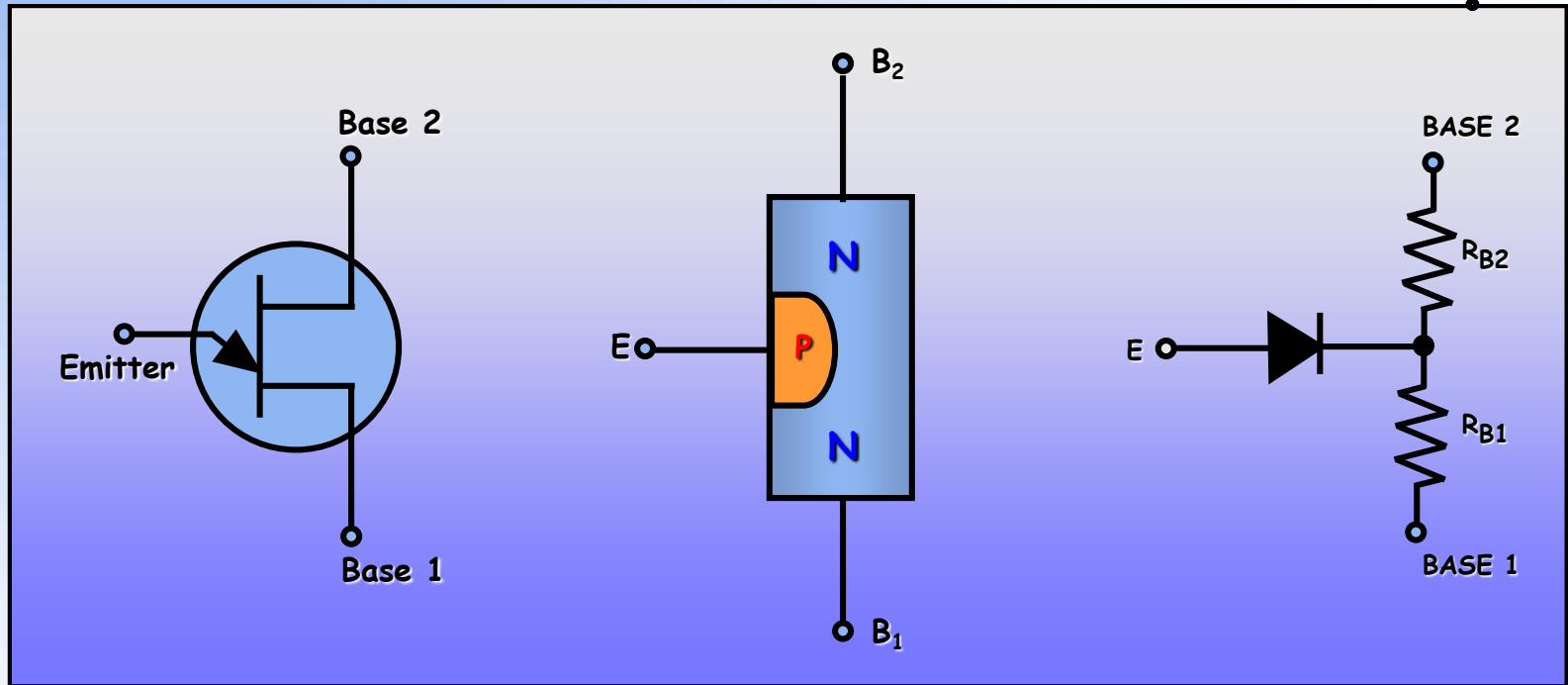
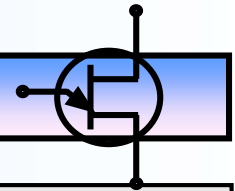
SCR; Ckt PC 52B. Cutoff.



UJT

Special Purpose Devices

UJT; Unijunction Transistor



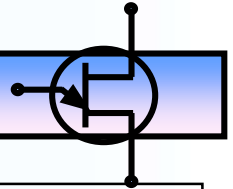
NITA LESSON;

Per Instructor Discretion.

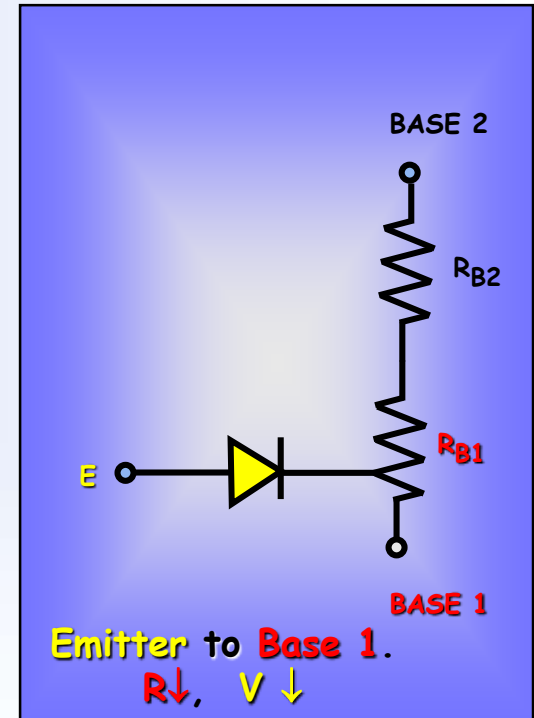
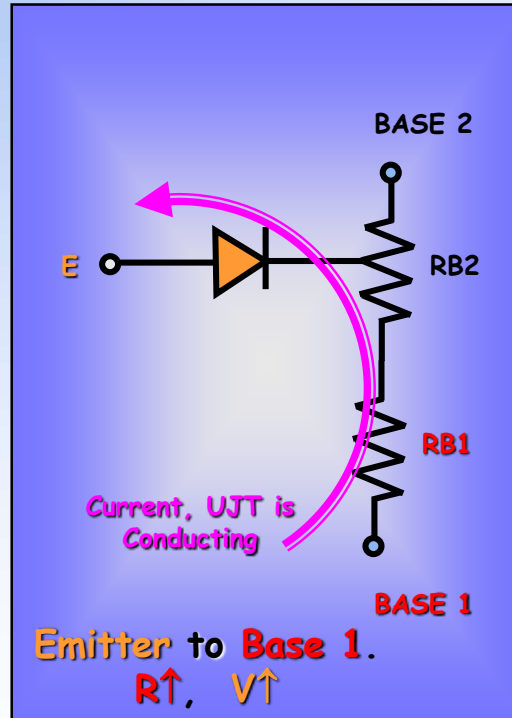
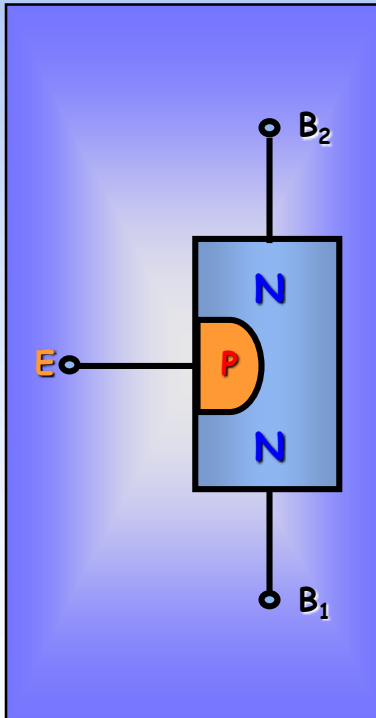
Continue UJT

Special Purpose Devices

UJT; Unijunction Transistor



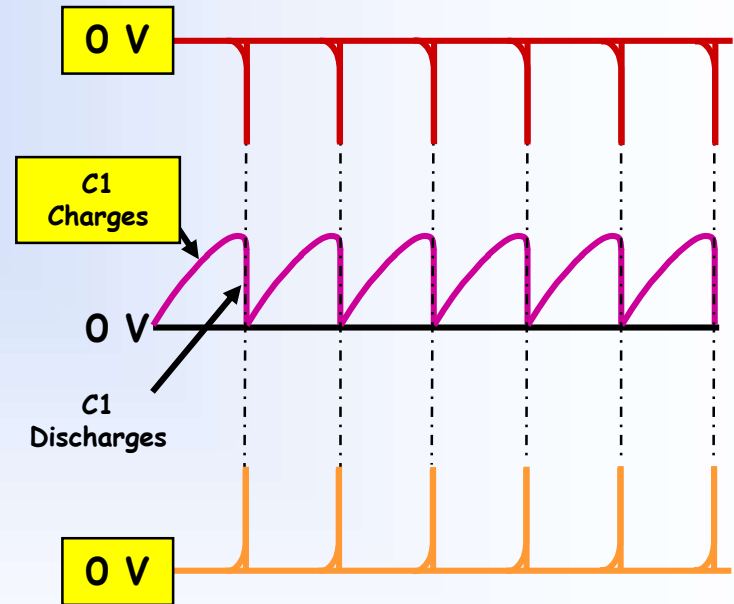
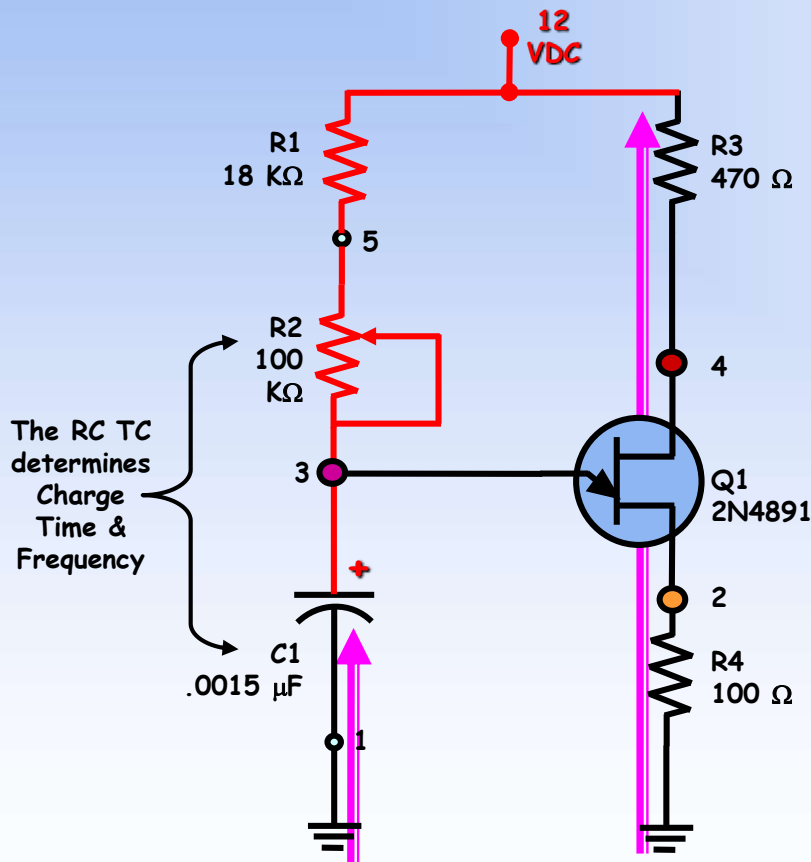
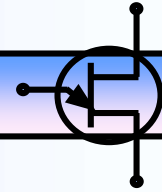
The position of the emitter fusing on the N material determines how much voltage is required to turn on the UJT @ the Emitter.



Continue, UJT Ops

Special Purpose Devices

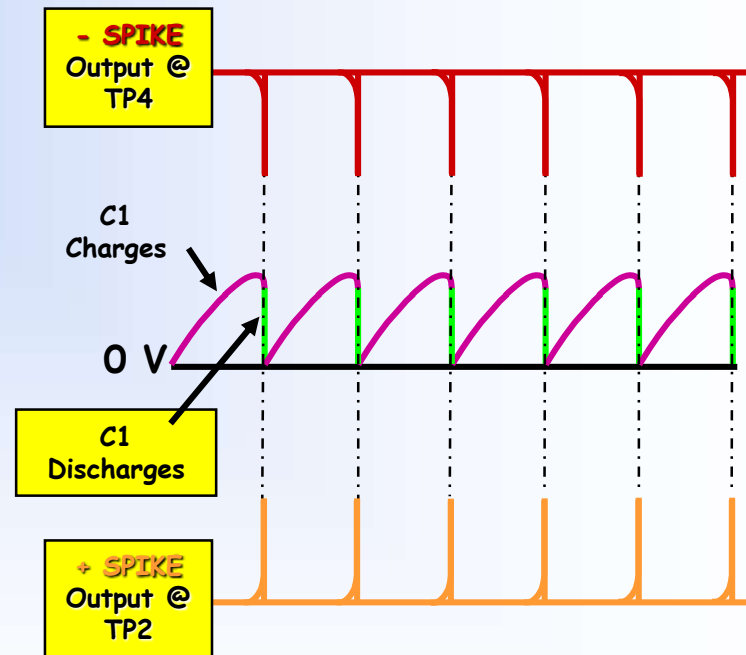
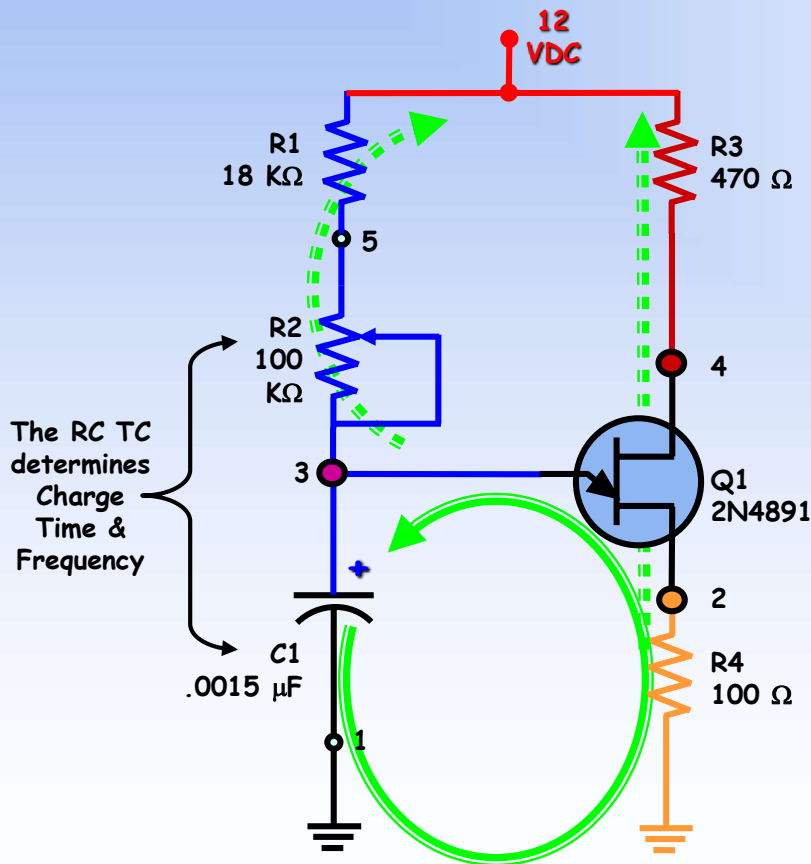
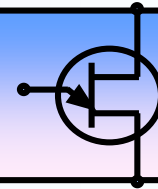
UJT; Oscillator PC 51 . Operation, C1 Charge.



C1 Discharge

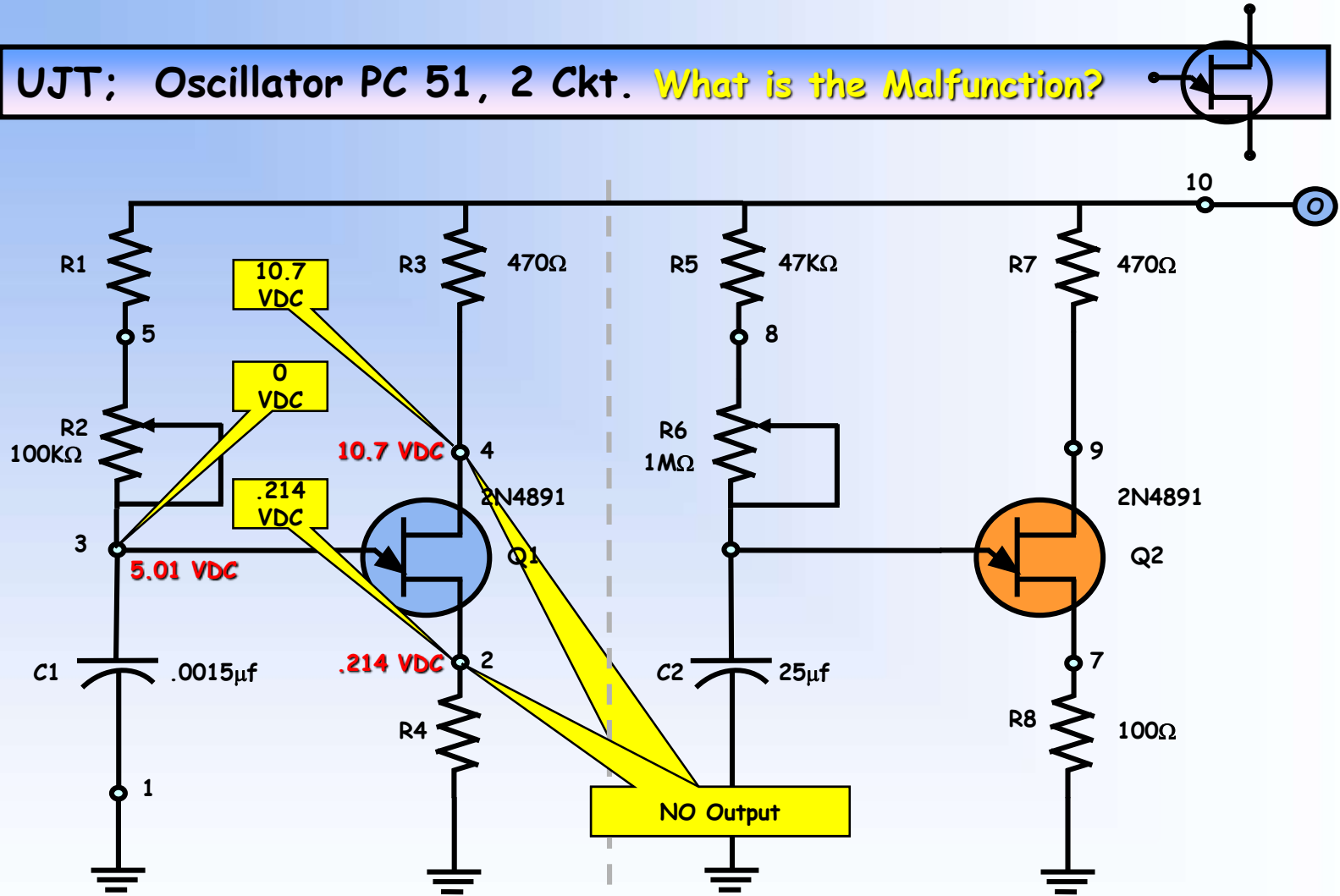
Special Purpose Devices

UJT: Oscillator PC 51 . Operation, C1 Discharge.
Output; + & - Spike. Saw tooth @ TP3.



Special Purpose Devices

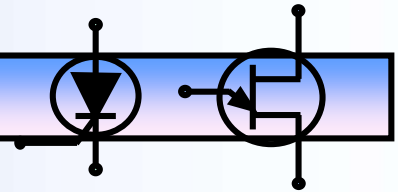
UJT; Oscillator PC 51, 2 Ckt. *What is the Malfunction?*



Terms

Special Purpose Devices

SCR & UJT; Terms.



SCR; Silicon Controlled Rectifier.

Referred to as a Gated Diode.

To Turn ON, F Bias + on Gate Cathode junction. [Gated On]

To Turn OFF, R Bias Anode/ Cathode thus removes Latching current.

Latching Current, the minimum amount of current that can flow through an SCR and hold it in the Break over condition or conduction.

UJT; Unijunction Transistor.

Referred to as a Double Based Diode.

Location of the emitter joined to the N material [PN Junction] determines the amount of voltage required @ the emitter to cause conduction through the Emitter.

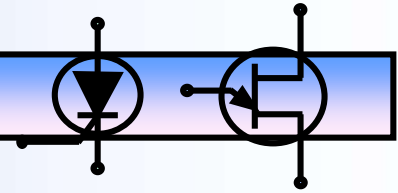
3 Waveforms Produced, + & - Spike, Saw tooth.

Main Use, Oscillator & Switching Trigger.

SCR & UJT; Both in the Family called Thyristors, [Electronic Switches].

Special Purpose Devices

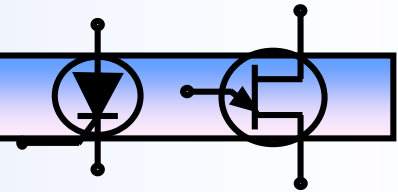
Review Questions;



1. One of the main uses of a UJT is as a _____, _____ .
2. Why is the UJT often used instead of a conventional transistor?
_____ .
3. The UJT is also called a _____ .
4. What is the Basic purpose of a SCR? _____ .
5. How is an SCR turned on ? _____ .
6. What family of transistors does the SCR & UJT belong to ?
_____ .
7. Draw the schematic symbol for a UJT & SCR.
8. How many PN Junctions does the SCR contain ? _____ .
9. How is an SCR turned Off ? _____
_____ .

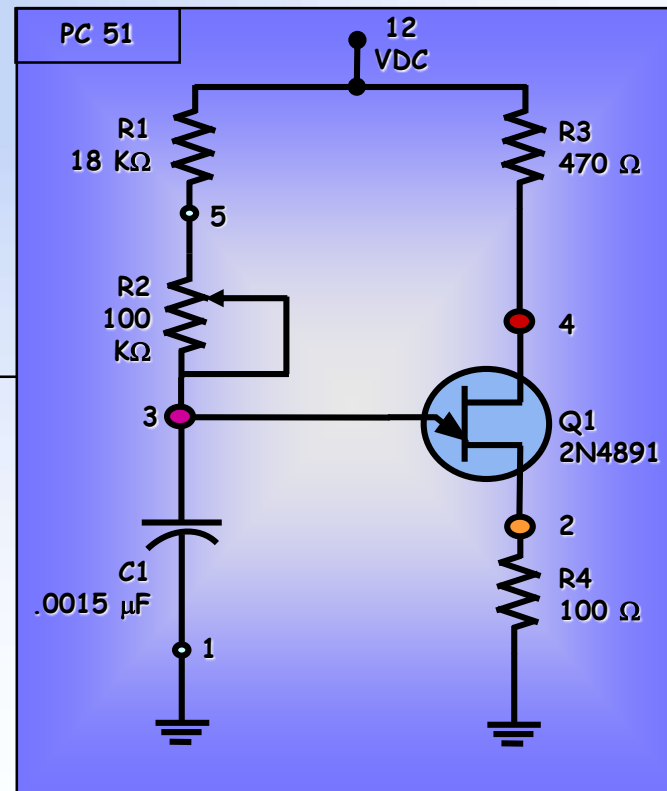
Special Purpose Devices

Review Questions:



10. Refer to PC 51; The following DC voltages are present: TP4 = 10.7 VDC, TP3 = 0 VDC, TP2 = .21 VDC. What is the Malfunction ?

- a. C_1 Open
- b. R_1 Open
- c. R_2 Short
- d. Q_1 Open



Answer; 10